SOLAR PANEL INPUT

Solar Panel (13-17V)

Reverse polarity protection

Q1 IRF9310TRPBF-1

SOLAR+

D3 PESD24VL1BA,115

SOLAR_PANEL_IN

GND

R1 523k

C1 10µF

R4 100k

LT3652 max 34Vin

U1 LT3652HVEDD#TRPBF

VIN, VIN_REG, SHDN, CHRG, FAULT, NTC, SW, BOOST, SENSE, BAT, VFB, TIMER, SGND

C2 1µF

D4 PMEG4050EP,115

SBA 3

SZBZX84C6V2LT1G

D1 PMEG4050EP,115

L1

Select 1A max

R2 0.1

+BAT

R184 0

R3 178k

C4 10µF

C3 100uF

R5 100k

R7 27k

RT1 NCP18XH103F03RB

R179 100k

R178 10k

C5 4.7µF

20 hours time

D5B SZBZX84C6V2LT1G

MH1 MH2 MH3

[8A] Fault_Panel_solar

J11 1844798

SOLAR+, GND, GND, BATTERY+

R170 10k NTC

RELAY1_P [2B]
RELAY1_N [2B]
RELAY2_P [2B]
RELAY2_N [2B]
RELAY3_P [2B]
RELAY3_N [2B]
RELAY4_P [2B]
RELAY4_N [2B]

Temperature sensor placed on the bottom of the PMC, near the battery,

NCP18XH103F03RB
0°C= 27K
25°C=10K
50°C=4,16K
75°C=1,95K

R6 910k

NTC

RT2 NCP18XH103F03RB

R8 1M

D6 PMEG4050EP,115

Select Vbat voltage

R9 56.2k

Variable voltage power supply: battery +possible solar panel (8.5V-17V)

U2 MP2322GQH-A.3

IN, EN, PG, VCC, SW, BST, FB, GND

C6 10µF, C7 10µF, C8 100nF

C12 1µF

D76 PMEG4050EP,115, D77

L2 SRN3015-3R3M

100nF C9

+3V3 TP_3V3

C10 22µF

R10 1M, 22pF C11

R11 220k

R181 0

[4A] VUSB

[2A] GATED_VBAT

Wide temperature range – from -15°C to 60°C

An external 12V (11 - 13.3V) / 518 Ah acid/lead SLA battery is used to power the PMC for 125-186 months, and it may be coupled to a solar panel (10-17 V) for perennial use, especially in R2-DX-smart version. R2-DL configuration (without modem) is powered in by a 9 V (6 x 1.59 V batteries)y, to be changed annually.

12V/5Ah acid/lead SLA battery (11 - 13.3V)

Q2 IRF9310TRPBF-1

BATTERY+

D8 PESD24VL1BA,115

Reverse polarity protection

+BAT

C18 100nF, C101 22µF, C17 22µF, C102 22µF

POWER GATING

ZXMP4A16GTA

Q3

R12 10k

C14 100nF

R18 10k

Q4A 2N7002PS,115

R21 100k

GATED_VBAT_ENABLE [4B]

[2C] VBAT_PROBE

R14 475k

R17 100k

GATED_VBAT

adc uP (7V=1,22V 18V 3,15V)

JNMP1

TP_GATED_BATT

R182 0

ZXMP4A16GTA Q41

R171 10k

C103 100nF

R172 10k

Q42A 2N7002PS,115

R173 100k

[4C] 19_Power-ON

C15 10µF

R174 100k

R15 100k

MP1542DK-A.4 U3

IN, FSEL, EN, SS, SW, FB, GND, COMP

C20 22nF

C106 22pF, C21 22pF

R20 32.4k

C22 47nF

R19 10k

PMEG4050EP,115 D7

L3

R13 17.4k

C19 2.2nF

R16 143k

100mA

+19V

C16 10µF, C13 10µF

U4 TPS54620RGYR

VIN, PVIN, PVIN, EN, SS/TR, RT/CLK, COMP, PH, PH, BOOT, VSENSE, PWRGD, EP, GND, GND

C23 22µF, C24 4.7µF, C25 4.7µF

C65 100nF

L4

R22 53.6k

TP_5V

+5V 4A max

C66 10µF, C67 10µF, C68 10µF

R23 10k

Fault_5V [8A]

C69 2.2nF

R75 53.6k

R180 1k

R155 1k

C71 47nF

C107 22pF, C70 22pF

Power Consumption

3 Wh/ year @12V -->mean 342Wh @12V >28,5uAh@12V-->103uA @3,3V
4 Wh/ year @12V -->mean 456Wh @12V >38uAh@12V-->138uA @3,3V

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Title	Challenge_R2DX
ID:	*
Revision	2
Date:	27/07/2020 Time: 15:46:26
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File:	01_Power.SchDoc
Author	F. Santagiuliana
Rev author	*

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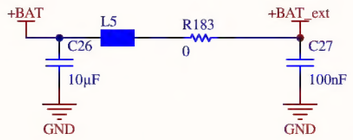
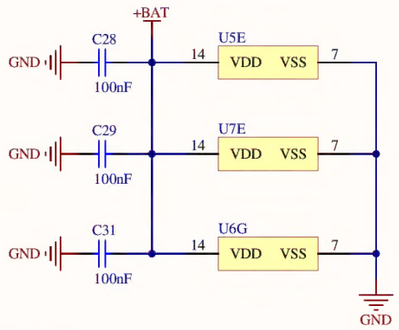
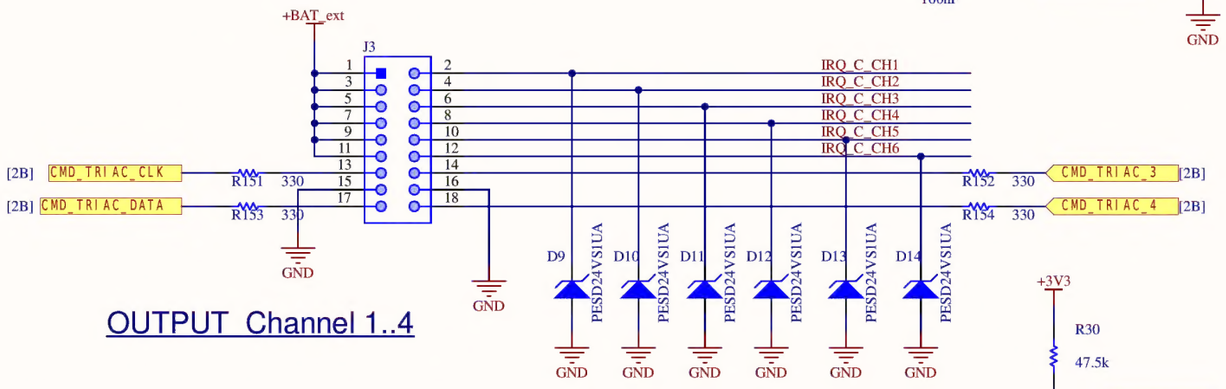
ARDUINO

INPUT ON/OFF Channel 1..6 (interrupt)

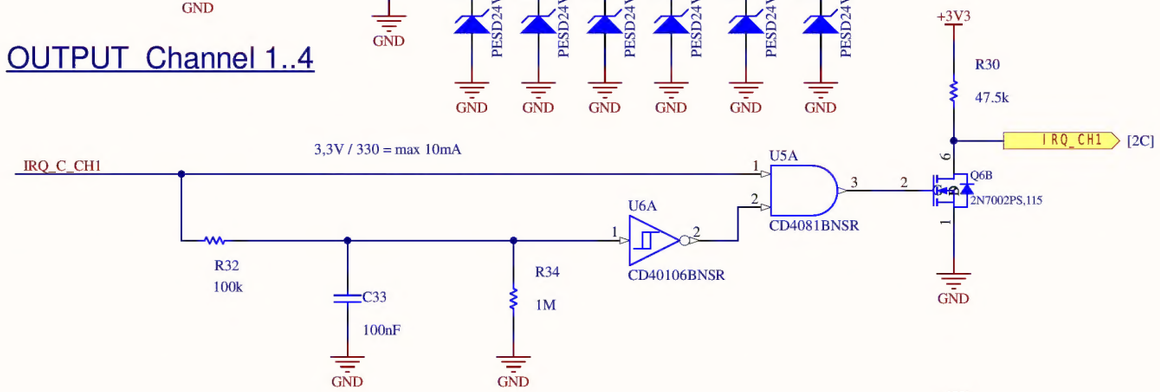
6 inputs on/off i for pluviometer, watermeter, switching pressure gauge, dry contacts

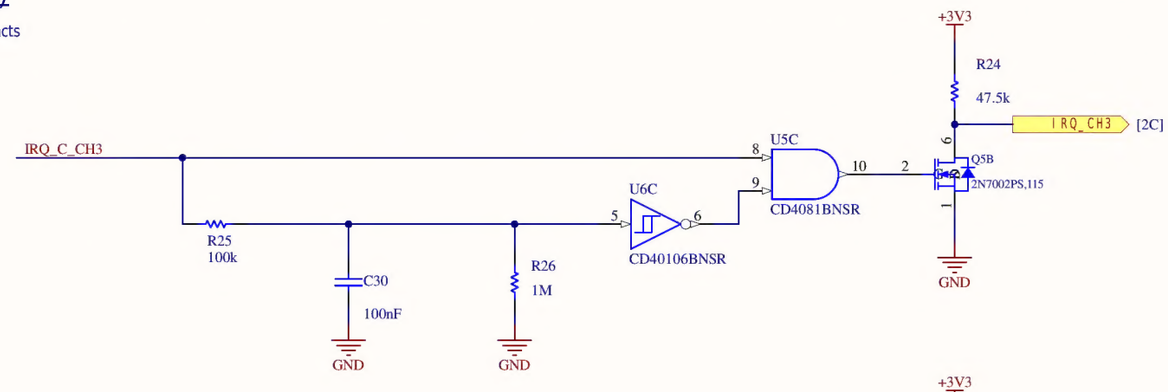


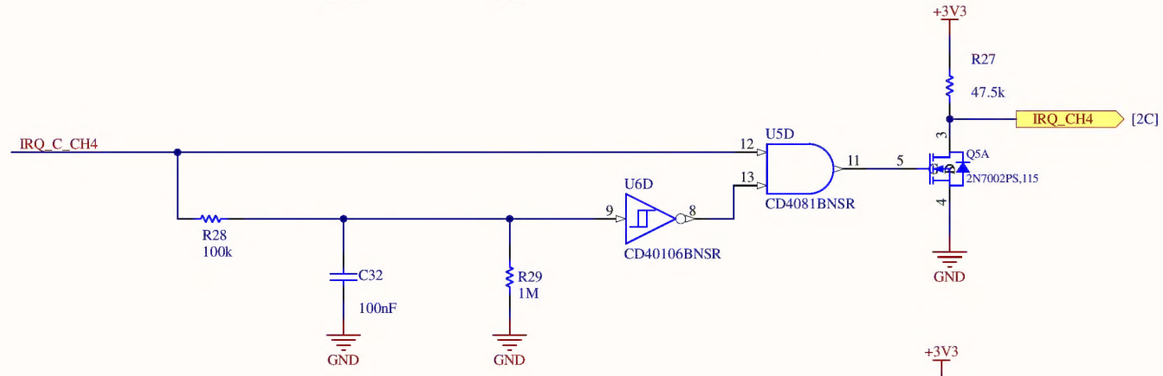


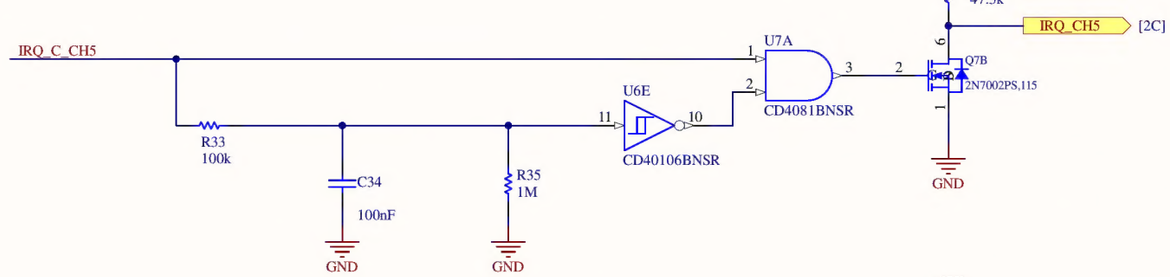


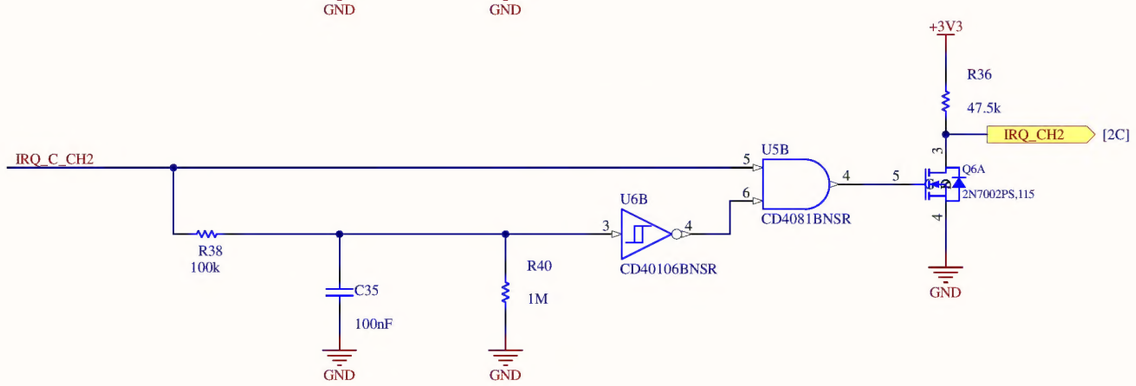
OUTPUT Channel 1..4

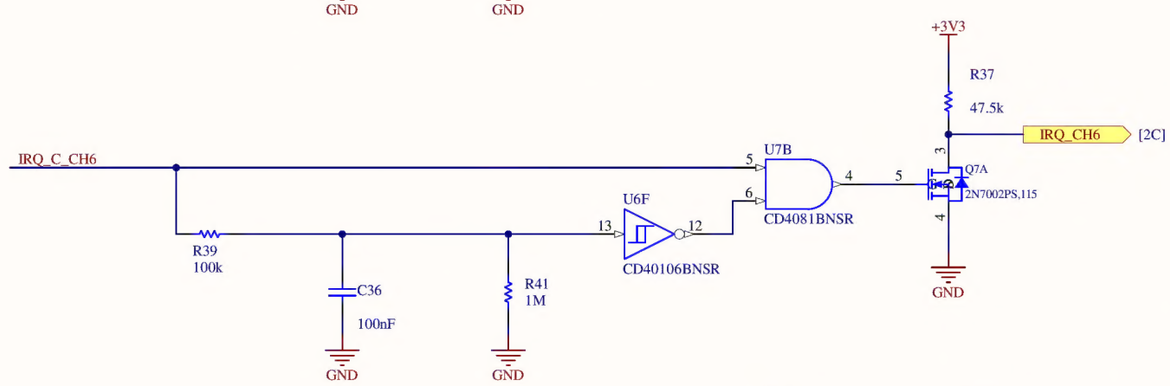


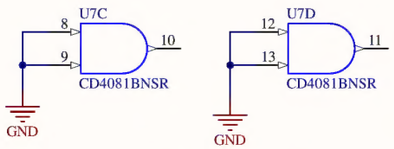












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Title	Challenge_R2DX
ID:	*
Revision	2
Date:	27/07/2020 Time: 15:46:27
Sheet	2 of 8
File:	02_onoff_interrupts.SchDoc
Author	F.Santagiuliana
Revauthor	*

F1=MF-FSMF050X-2

USB

J5

VBUS
USB_D- _C
USB_D+ _C
(USBID Unused)
SH

R46 22 USB_D-
R47 22 USB_D+

TP1 TP2 TP3 TP4

R48 1M C43 4.7nF

F1 L6 C38 100nF C39 10µF VUSB [4A]

D17

Battery holder CR2032 J4

+3V3 D15 D16 R45 22 +3V3_BCK C37 100nF

[2A] VUSB

U9B
10 VCC
31 VBUS
9 VCCIO
C40 100nF

GND GND GND GND GND GND GND GND GND GND GND GND GND GND GND GND GND GND GND GND GND GND

U10
+5V C42 100nF
3 VIN VOUT 4 V_REF
1 NC TRIM 5
GND 2 GND
C41 100nF

U8
[3C], [5C] I2C_SCL 29 SCL P00 1
[3C], [5C] I2C_SDA 30 SDA P01 2 Fault_Panel_solar [2A]
P02 3 Fault_5V [8D]
26 ADDR P03 4 ON_LCD
P04 5 DEMUX_SEL0 [7A], [7C]
P05 6 DEMUX_SEL1 [7A], [7C]
P06 7 DEMUX_SEL2 [7A], [7C]
P07 8 DEMUX_SEL3 [7A], [7C]
P10 9 WaterMrk_EN [7D]
P11 10 0-5V_INPUT_EN [7A]
P12 11 SENSOR_DISCHARGE [2D]
P13 12 SENSOR_HIGH_P [2D]
P14 13 PULSE_CNTL0 [2B]
P15 14 PULSE_CNTL1 [2B]
P16 15 PULSE_CNTL2 [2B]
P17 16 PULSE_CNTL3 [2B]
P20 17 LCD_BACKLIGHT
P21 18 LCD_D4
P22 19 LCD_D5
P23 20 LCD_D6
P24 21 LCD_D7
P25 32 INT P26 22 LCD_RS
P27 28 RESET 23 LCD_EN
24 LCD_RW
31 VCCI EP 33
27 VCCP GND 25
TCA6424ARGJR

+5V R42 330 LED1
+5V R43 100k R44 100k
+3V3_GT R49 10k
+3V3_GT C44 100nF C45 100nF
GND

J2
1 1 2 POWER_ON
+5V_LCD 3 4 LCD_RS
CONTR 5 6 LCD_RW
LED+ 7 8 LCD_EN
9 9 10 LCD_D4
11 11 12 LCD_D5
13 13 14 LCD_D6
15 15 16 LCD_D7
61201623021

U9A NINA-B306

[3B] CMD_TRIAC_CLK	1	GPIO1	
[3B] CMD_TRIAC_DATA	2	GPIO2	
[3B] CMD_TRIAC_3	3	GPIO3	
[3C] CMD_TRIAC_4	4	GPIO4	
[6C] TXD_MKR2	5	GPIO5	
[6C] RXD_MKR2	7	GPIO7	
[2D] SENSOR_CALIB	16	GPIO16_A	
V_REF	17	GPIO17_A	
	18	GPIO18_A	
[6C] I2C_SCL_2	20	GPIO20_A	
[6C] I2C_SDA_2	21	GPIO21	
SD_CS	22	GPIO22	
[5C] VBAT_PROBE	23	GPIO23_A	
[7A] 0-5V_SENSOR_INPUT_ADC	24	GPIO24_A	
[2D] SENSOR_CAPTURE	25	GPIO25_A	
[7D] SENSOR_COMMON	27	GPIO27_A	
[3B] PULSE_DIRECTION	34	GPIO34	
[3C] PULSE_STROBE	35	GPIO35	
[4B] ON_MKR1	36	GPIO36	
[7B] ON_MKR2	37	GPIO37	
[3B] TXD_MKR1	38	GPIO38	
[3C] RXD_MKR1	39	GPIO39	
[7A] IRQ_CH1	40	GPIO40	
[7A] IRQ_CH2	41	GPIO41	
[7A] IRQ_CH3	42	GPIO42	
[7A] IRQ_CH4	43	GPIO43	
[7A] IRQ_CH5	44	GPIO44	

USB_DM 55, USB_DP 54

ANT 13
NFC1/GPIO28 28 SENSOR_CAPTURE [2C]
NFC2/GPIO29 29 GATED_VBAT_ENABLE [4C]
RESETN 19 RESETN
SWDCLK 11 SWDCLK
SWDIO 5 SWDIO
TRACECLK/GPIO45 45
SWO/TRACE_D0/GPIO8 8 19_Power-ON [6C] IRQ_CH6
TRACED1/GPIO46 46 GATED_3V3_ENABLE_N
TRACED2/GPIO32 32 I2C_SCL I2C_SCL [3C], [6A]
TRACED3/GPIO33 33 I2C_SDA I2C_SDA [3C], [6A]

QSPID3/GPIO47 47, QSPID1/GPIO48 48, QSPID2/GPIO49 49, QSPID0/GPIO50 50, QSPICS/GPIO51 51, QSPICLK/GPIO52 52

GPIOCLK, QSPIDCS, QSPID0, QSPID2, QSPID1, QSPID3

TPSWDCLK TPSWDIO

+3V3_GT R50 10k R51 10k
+3V3 R52 10k
POWER_ON

+3V3 RESET C46 100nF GND
RESET [3B], [6C]
RESET BUTTON SW1
+3V3_GT R53 10k R54 10k

LCD_BACKLIGHT 5 Q9A R63 100k GND

+5V Q8 R56 10k C47 100nF +5V_LCD
R61 475 R55 32.4k R57 1k
ON_LCD 2 Q9B R59 100k

J1
1 1 2 POWER_ON
3 4 LCD_RS
CONTR 5 6 LCD_RW
LED+ 7 8 LCD_EN
9 9 10 LCD_D4
11 11 12 LCD_D5
13 13 14 LCD_D6
15 15 16 LCD_D7

DEBUG

CN1
SWDIO 2 1 +3V3_BCK
SWDCLK4 3
6 5
8 7
RESETN10 9

SD CARD

J6
SD_CS 1 DATA2
QSPID0 2 CD/DAT3/SS
3 CMD/MOSI
4 VDD
GPIOCLK 5 CLK/SCK
6 VSS
QSPID1 7 DAT0/MISO
8 DAT1
CD1 CD1
CD2 CD2
SH1 SH2 SH3 SH4 G1 G2 G3

LCD DISPLAY 16X2

Logic Supply Current Vdd=5V- Idd=1.5mA

VF=max 4,6V IF Ty=100mA

I=(5-4,2)/ 8,2=97mA

R41 varia da 8,2 ohm a 390 ohm a seconda del tipo di LCD !!!!
Theorically, R78 could have been changed from 8,2 to 150 ohms
da datasheet dovrebbe essere 400 ohm

U11A
QSPIDCS 1 /CS /HOLD 7 QSPID3
GPIOCLK 6 CLK
QSPID0 5 DI
QSPID1 2 DO
QSPID2 3 /WP

U11B
+3V3_GT C52 100nF
8 VCC
9 EP
4 GND
W25Q16JVZPIQ

From WATERMARK SENSOR

[7C] WaterMrk_SENSOR_INPUT_ADC R58 7.87k SENSOR_CALIB [2C]
R60 220 SENSOR_CAPTURE [2C]
C48 100nF
ad un pin del micro
SENSOR_DISCHARGE [7B]
SENSOR_HIGH_P [7B]
Q11A Q11B
R65 100 C51 100nF

DEBUG

+3V3 Q10 +3V3_GT
C49 100nF R62 10k C50 100nF
GATED_3V3_ENABLE_N R64 1k

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Title	Challenge_R2DX		
ID:	*	Revision	2
Date:	27/07/2020 Time: 15:46:28	Sheet	3 of 8
File:	03_processor.SchDoc	Author	F.Santagiuliana Rev author *

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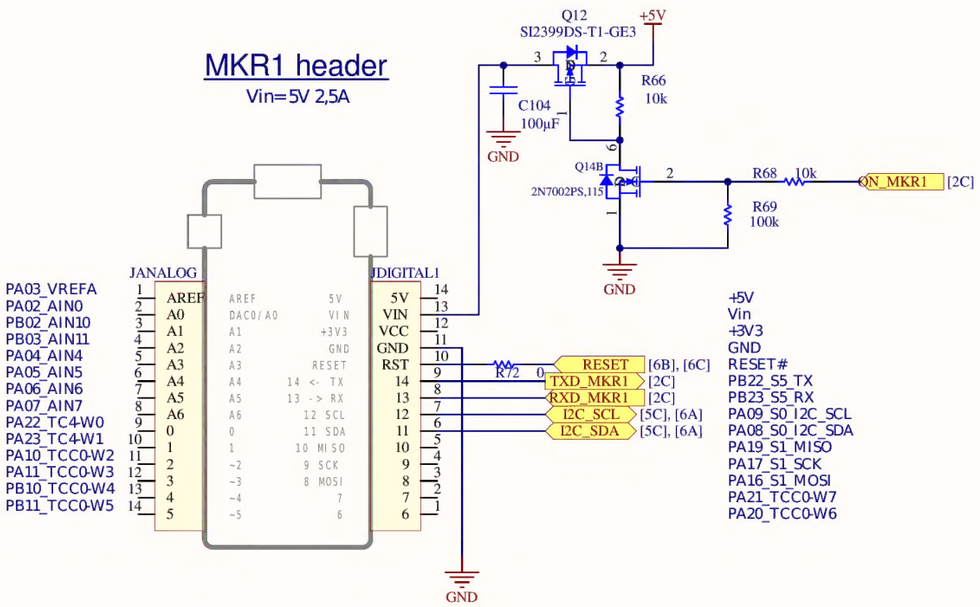
ARDUINO

MKR Arduino Expantions

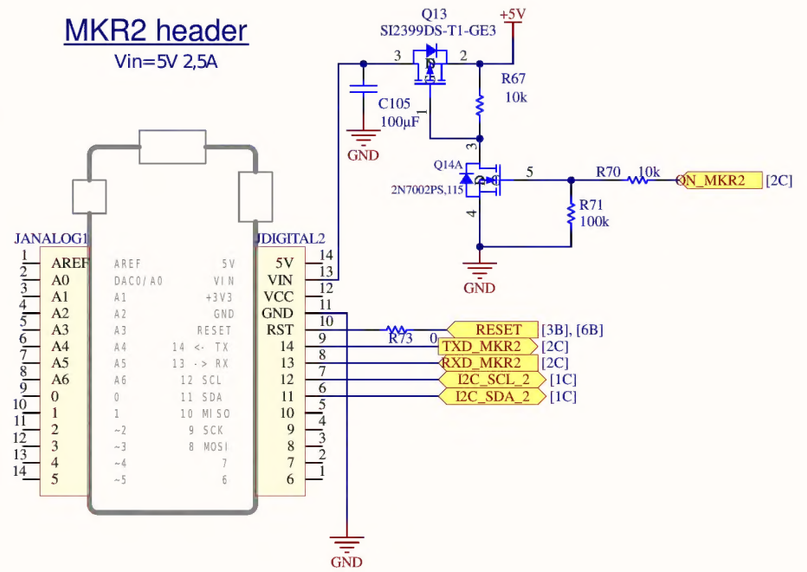
MKR1 header

Vin=5V 2,5A



MKR2 header

Vin=5V 2,5A



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Title	Challenge_R2DX		
ID:	*	Revision	2
Date:	27/07/2020 Time: 15:46:30	Sheet	4 of 8
File:	04_mkr_connectors.SchDoc	Author	F.Santagiuliana
		Revauthor	*

0-5V input Channel 1..8
Temperature sensor (from +5V and lines)

TVS per 15V = SMA6J15A/CA

CONNECTOR INPUT

J7 — 1844798

Conn_4-20mA_CH1
Conn_4-20mA_CH2
Conn_4-20mA_CH3
Conn_4-20mA_CH4
+5V-CONN

0-5V_CH1_P [5A]
0-5V_CH2_P [5A]
0-5V_CH3_P [5A]
0-5V_CH4_P [5A]
0-5V_CH5_P [5A]
0-5V_CH6_P [5A]
0-5V_CH7_P [5A]
0-5V_CH8_P [5A]

D18 D19 D20 D21 D22 D23 D24 D25 D26 D27 D28 D29 — Diode Zener

8 inputs 0-5 V reading sensors, to connect tensiometers and dendrometers (new application)

(tensiometer IRROMETER RSU-V
OUTPUT VOLTAGE: 0.5 to 4.5 V, 2.5 mA
SUPPLY VOLTAGE: 5VDC (+/ –0.5VDC) SUPPLY CURRENT: 10 mA

U12 — MC14067BDWG

[4A] 0-5V_CH1_P
[4A] 0-5V_CH2_P
[4A] 0-5V_CH3_P
[4A] 0-5V_CH4_P
[4A] 0-5V_CH5_P
[4A] 0-5V_CH6_P
[4A] 0-5V_CH7_P
[4B] 0-5V_CH8_P

R74 10k
C53 100nF
R76 17.4k
0-5V_SENSOR_INPUT_ADC [2C]

DEMUX_SEL0 [7A], [7C]
DEMUX_SEL1 [7A], [7C]
DEMUX_SEL2 [7A], [7C]
DEMUX_SEL3 [7A], [7C]
0-5V_INPUT_EN [7A]

R78 220 R79 220 R80 220 R81 220
R156 178k R157 56.2k C72 100nF
C54 100nF C55 100nF

	-55°C	-20°C	+25°C	+26°C	+85°C	100°C
200TS_Temp_sensor	963849	97081,38	10K	9572	1070	679
Valim	5	5	5	5	5	5
Rpart down	18000	18000	18000	18000	18000	18000
Rpart up	10000	10000	10000	10000	10000	10000
Vdac	0,091	0,720	2,368	2,395	3,096	3,138

Temperature Sensor: 200TS:
-55°C=963849
+25°C=10K
+85°C=1069.84
+100°C=678.6

R77 0 — alternativo ad AP2141
U13 — AP2141WG-7
C56 10µF C57 10µF
+5V-CONN

oppure AP21410/AP21510D

INPUT WATERMARK SENSORS Channel 1..16

WaterMrk[1..16]

J8 — 1844798

WaterMrk1 1 — 2 WaterMrk2
WaterMrk3 3 — 4 WaterMrk4
WaterMrk5 5 — 6 WaterMrk6
WaterMrk7 7 — 8 WaterMkr8
WaterMrk9 9 — 10 WaterMkr10
WaterMrk11 11 — 12 WaterMkr12
WaterMrk13 13 — 14 WaterMkr14
WaterMrk15 15 — 16 WaterMkr16
17 — 18

D30 D31 D32 D33 D34 D35 D36 D37 D38 D39 D40 D41 D42 D43 D44 D45 — Diode Zener

R82 R83 R84 R85 R86 R87 R88 R89 R90 R91 R92 R93 R94 R95 R96 R97 — 1M

SENSOR_COMMON
D46 — Diode Zener

U14 — MC14067BDWG

WaterMrk1 9
WaterMrk2 8
WaterMrk3 7
WaterMrk4 6
WaterMrk5 5
WaterMrk6 4
WaterMrk7 3
WaterMkr8 2
WaterMrk9 23
WaterMrk10 22
WaterMrk11 21
WaterMrk12 20
WaterMrk13 19
WaterMrk14 18
WaterMrk15 17
WaterMrk16 16

WaterMrk_SENSOR_INPUT_ADC [1D]

DEMUX_SEL0 [7A]
DEMUX_SEL1 [7A]
DEMUX_SEL2 [7A]
DEMUX_SEL3 [7A]
WaterMrk_EN [7A]

C58 100nF

74HC4067 oppure MC14067BDWG

SENSOR_COMMON [2C]

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Title	Challenge_R2DX
ID:	*
Revision	2
Date:	27/07/2020 Time: 15:46:31
Sheet	5 of 8
File:	05_watermark_5V_inputs.SchDoc
Author	F.Santagiuliana
Revauthor	*

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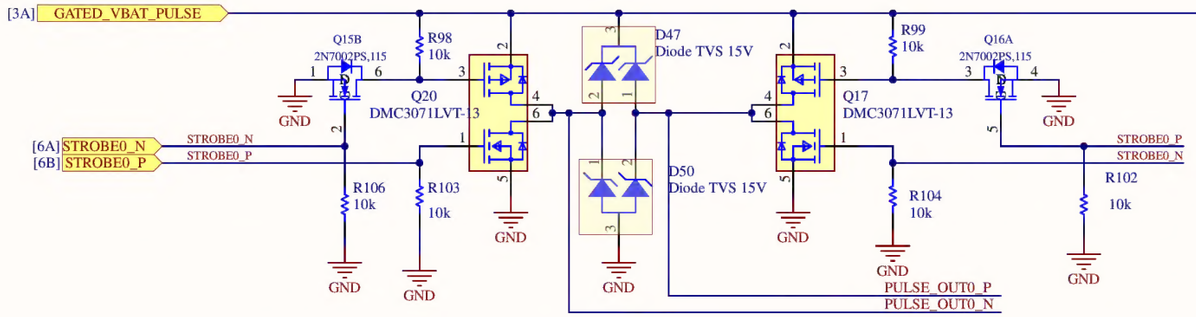
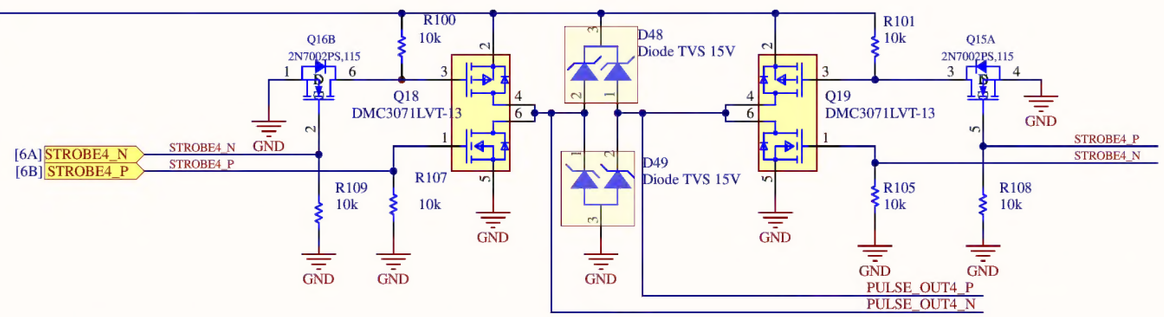
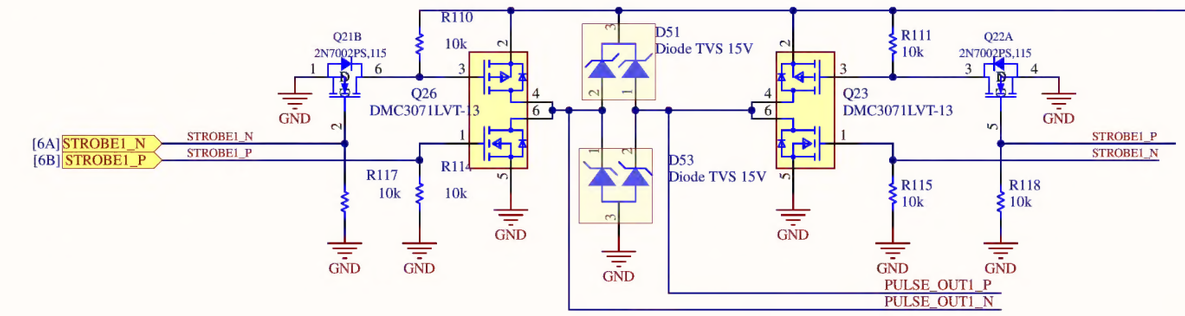
ARDUINO

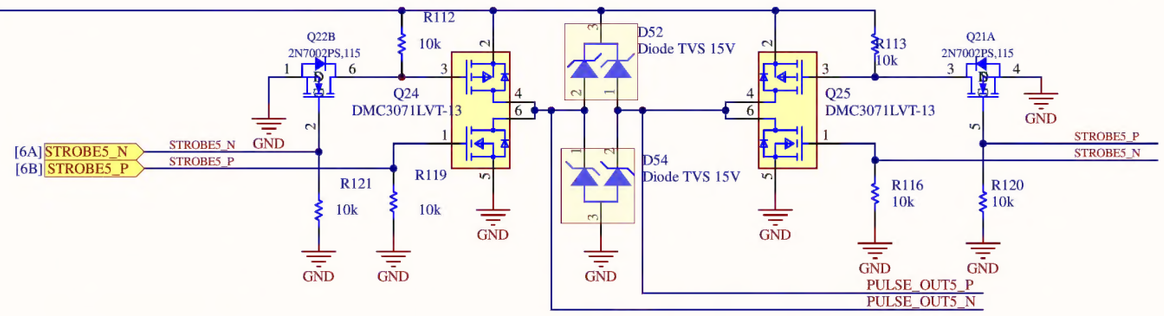
OUT LATCHING Channel 1..8

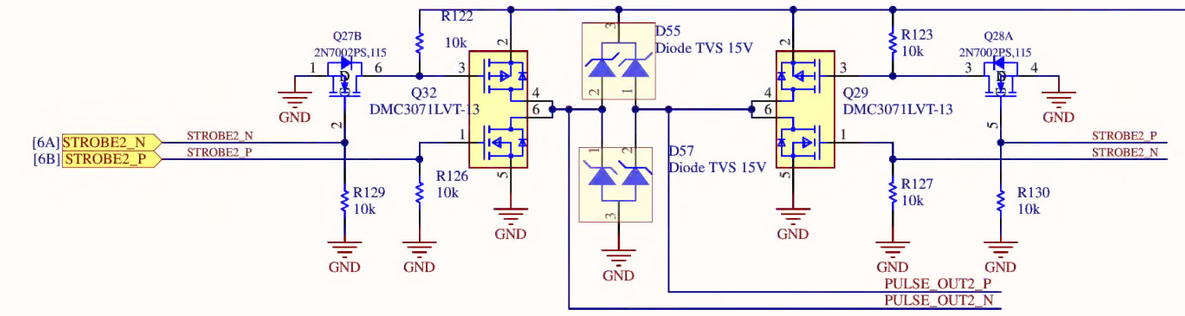
PROTEZIONI OUTPUT CONTRO CORTOCIRCUITI?

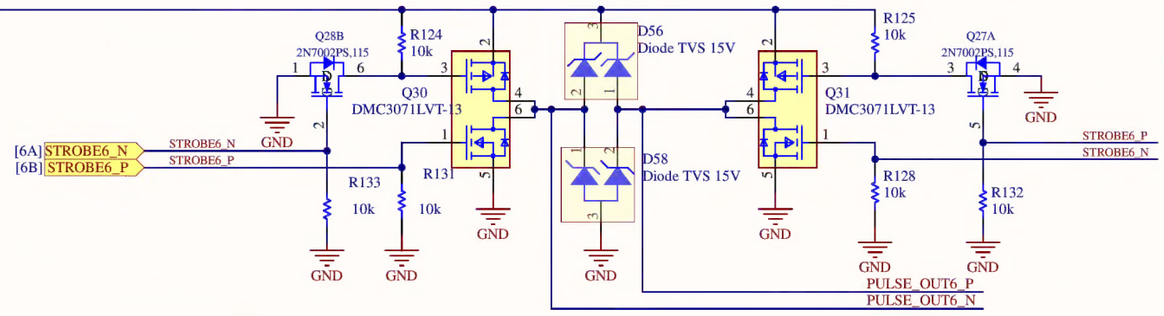


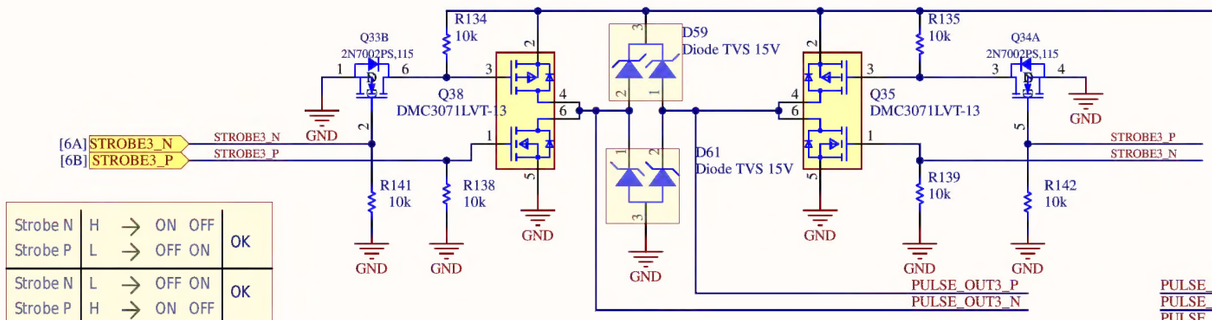


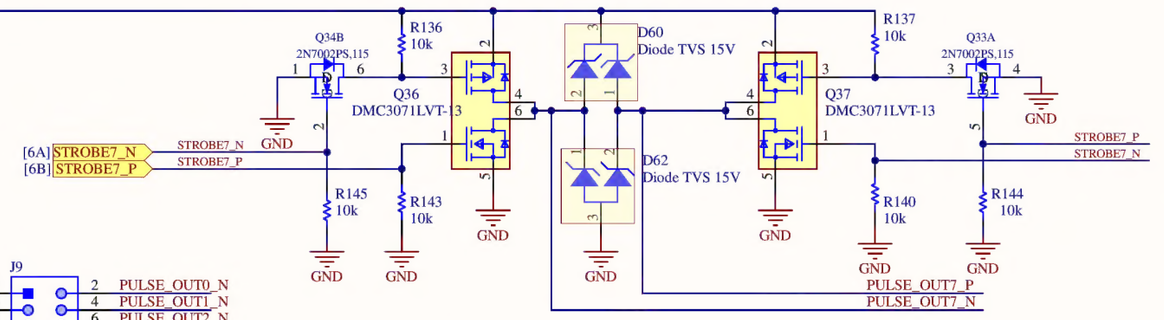




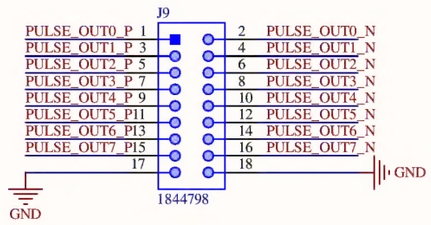








Strobe N	H →	ON OFF	OK
Strobe P	L →	OFF ON	
Strobe N	L →	OFF ON	OK
Strobe P	H →	ON OFF	
Strobe N	H →	ON ON	KO
Strobe P	H →	ON ON	
Strobe N	L →	OFF OFF	FREE
Strobe P	L →	OFF OFF	



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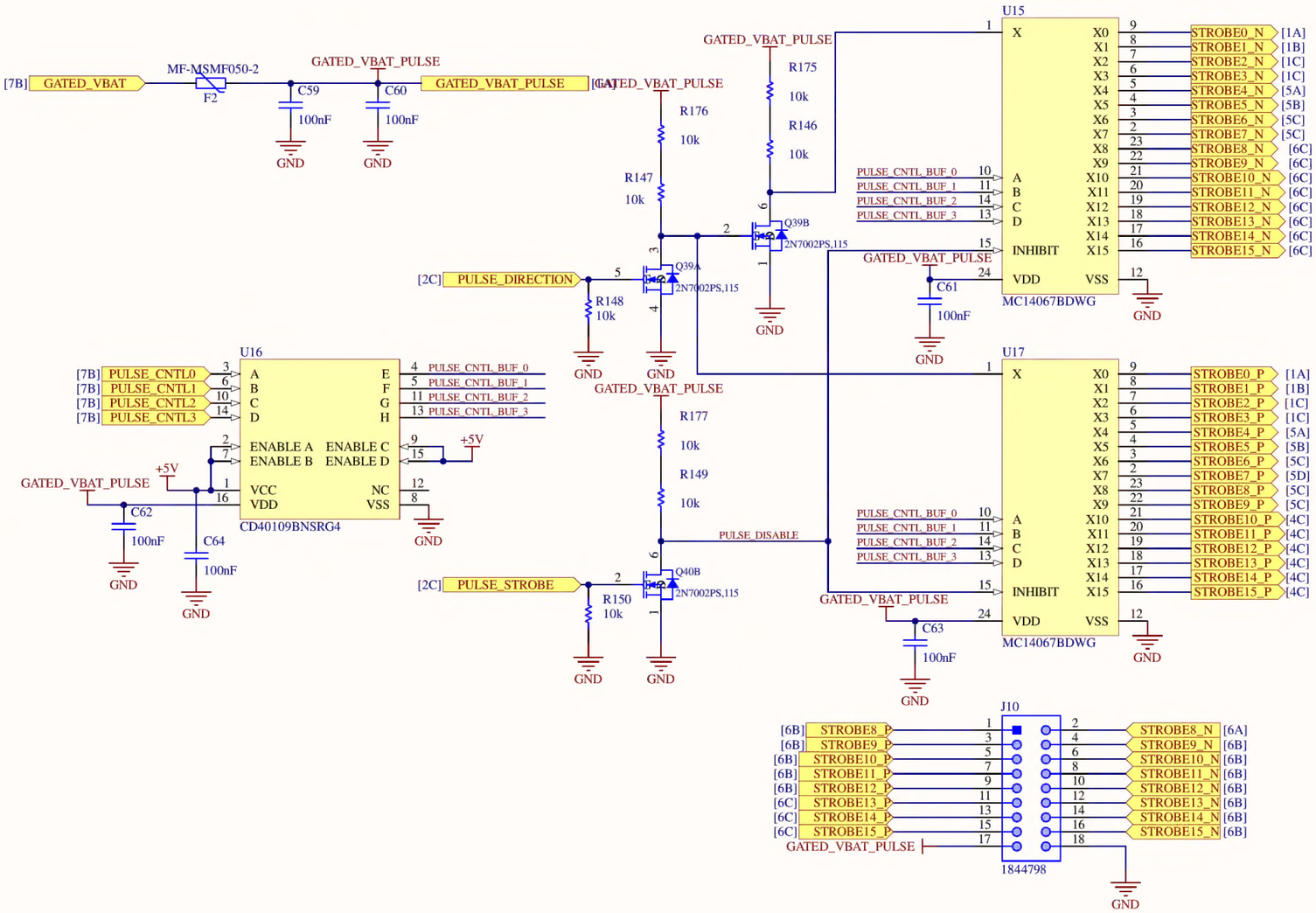
Title	Challenge_R2DX		
ID:	*	Revision	2
Date:	27/07/2020 Time: 15:46:32	Sheet	6 of 8
File:	06_latching_out_1-8.SchDoc	Author	F.Santagiuliana
		Revauthor	*

OUT LATCHING COMMANDs Channel 1..8



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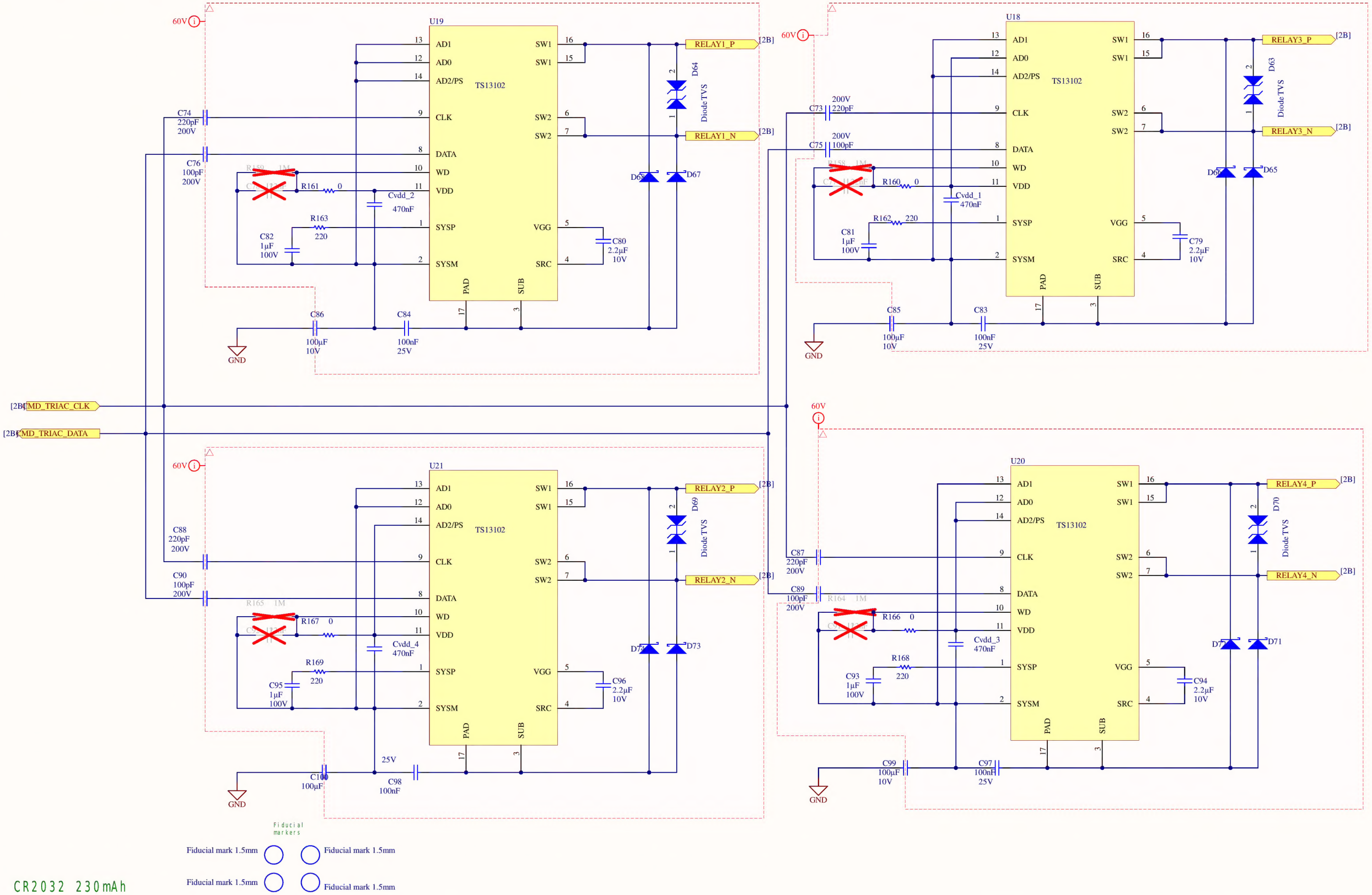
Title	Challenge_R2DX
ID:	*
Revision	2
Date:	27/07/2020 Time: 15:46:34
Sheet	7 of 8
File:	07_latching_out_cmd.SchDoc
Author	F. Santagiuliana
Rev	author



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Title	Challenge_R2DX		
ID:	*	Revision:	*
Date:	27/07/2020 Time: 15:46:35	Sheet	8 of 8
File:	08_triac_out.SchDoc	Author	F.Santagiuliana
		Revauthor	*